

Effect of Feeding Graded Levels of Fat With and Without Choline and Antibiotic + B₁₂ Supplements to Chicks*

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THE trend to high energy rations in the production of broilers has led to increased interest in the possibility of

adding fat to this type ration. Reiser and Pearson (1949) used lard and hydrogenated vegetable oils in chick starter rations and the addition of these fats showed no deleterious effects on the growth of chicks. Buckner *et al.* (1947) have also indicated that the addition of 17% corn oil to ra-

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tions for laying hens showed no deleterious effects although utilization of the corn oil was not complete.

Studies with rats (Pearson and Panzer, 1949; Barki *et al.*, 1950; Geyer *et al.*, 1945; Deuel *et al.*, 1947) and weanling dogs (Siedler and Schweigert, 1952) have indicated that added levels of fat improved the general performance of the animals. Barki *et al.* (1950) have shown that the response of rats to added levels of fat in the diet is not attributable to the essential fatty acids present and Pearson and Panzer (1949) have indicated that the response of the rat to high fat diets may be due to retention of the feed in the gut for longer periods of time with higher levels of fat which resulted in a more complete utilization of the ration.

It was of interest, therefore, to determine the response of chicks fed an experimental diet composed of natural ingredients and graded levels of inedible grade animal fat stabilized with antioxidants. In addition, the effect of choline supplementation was studied in view of the work of Kummerow *et al.* (1949) in which the choline requirement of the chick was increased by the addition of high levels of fat in the diet. An antibiotic supplement was also tested with graded levels of fat in order to determine if the caloric density of the ration influenced the response to antibiotic supplementation.

EXPERIMENTAL

A diet comprised of natural ingredients was formulated to be adequate in all known nutrients and low in fiber. The composition and proximate analyses of the basal ration are given in Tables 1 and 2.

Stabilized choice white grease was added to this basal ration at 2, 4 and 8% levels at the expense of the entire ration. The grease was stabilized by adding

TABLE 1.—Composition of basal ration

Ingredients	Percent
Yellow corn, ground	65.2
Soybean grits (solvent extracted)*	11.0
Meat scrap	8.0
Fish meal, Menhaden	8.0
Blood meal	2.0
Corn gluten meal	2.0
Alfalfa leaf meal, dehydrated	2.0
Butyl fermentation solubles (BY-500)	1.0
Fish oil (2,250 U.S.P. units A—400 A.O.A.C. units D per gram)	0.3
Iodized salt	0.5
MnCl ₂ ·4H ₂ O	mg./kg. 320
Niacin	20

* A different soybean meal of lower protein content was used in the second experiment (see text and Table 2).

TABLE 2.—Proximate analyses of basal rations*

	Exp. 1	Exp. 2
	%	%
Moisture	10.9	10.8
Protein (N×6.25)	23.7	22.9
Fat (ether extract)	3.4	3.9
Ash	6.3	6.2
Fiber	2.5	2.8

* Made by the Service Laboratory, American Meat Institute Foundation.

0.02% butylatedhydroxyanisole, 0.01% citric acid and 0.005% propyl gallate to the melted fat at 80°C. (Neumer and Dugan, 1952; Dugan *et al.*, 1950). In addition to these levels of fat, either no supplement, 0.2% choline chloride or 0.2% choline chloride plus 0.25% aureomycin-vitamin B₁₂ supplement was added.

The chicks were wing banded, weighed, randomized into twelve groups as uniformly as possible and kept on wire in electrically heated brooders. At the fourth week on experiment the chicks were moved to larger batteries (finishing batteries). Feed and water were supplied *ad libitum*. The chicks were weighed at weekly intervals and feed consumption data were recorded.

Experiment 1 was conducted with 300 New Hampshire chicks (mixed sexes).

TABLE 3.—Gain and feed utilization of New Hampshire chicks fed graded levels of fat

Supplement to basal ration	No. chicks	No. ♂♂	Ave. wt. ♂♂ 6 wks.	Ave. wt. ♀♀ 6 wks.	Food ² eff. 2-6 wks.	Cal. ³ eff. 2-6 wks.	Ave. wt. ♂♂ 9 wks.	Ave. wt. ♀♀ 9 wks.	Food eff. 2-9 wks.	Cal. eff. 2-9 wks.
None	25	12	gm. 803	gm. 715	0.40	11.4	gm. 1,335	gm. 1,171	0.38	10.8
2% Fat	23	11	745	675	0.41	11.3	1,322	1,115	0.38	10.4
4% Fat	24	15	827	629	0.44	11.8	1,414	1,047	0.39	10.4
8% Fat	24	15	809	703	0.44	11.2	1,409	1,107	0.39	9.9
0.2% Choline	25	11	847	670	0.43	12.2	1,402	1,082	0.37	10.5
0.2% Choline	25	13	802	704	0.41	11.3	1,390	1,144	0.36	9.9
+2% Fat										
0.2% Choline	25	15	829	672	0.44	11.8	1,431	1,078	0.40	10.7
+4% Fat										
0.2% Choline	22	12	766	684	0.43	11.0	1,338	1,130	0.38	9.7
+8% Fat										
0.2% Choline	26	12	865	664	0.43	12.2	1,430	1,051	0.37	10.5
0.25% Aureofac ¹										
0.2% Choline+	26	14	847	689	0.44	12.1	1,437	1,110	0.39	10.7
0.25% Aureofac										
+2% Fat										
0.2% Choline+	26	15	832	642	0.44	11.8	1,387	1,013	0.38	10.2
0.25% Aureofac										
+4% Fat										
0.2% Choline+	25	14	775	633	0.43	11.0	1,338	1,047	0.39	9.9
0.25% Aureofac										
+8% Fat										

¹ Aureomycin (1.8 gm./lb.) + Vitamin B₁₂ (1.8 mgm./lb.) supplement.² Grams gain/gm. food consumed.³ Grams gain/100 crude calories consumed.

Food consumption data were recorded from the second week on experiment through the sixth and ninth week. Experiment 2 was conducted with 300 mixed sex White Rock chicks. Food consumption data were recorded from the first through the fourth, sixth, and ninth week. Unfortunately, a high proportion of the White Rock chicks were females.

The soybean meal used in the formulation of the basal ration in experiment 1 was not available at the time experiment 2 was performed and a new source, lower in protein content was used (see Table 1).

RESULTS AND DISCUSSION

The results with New Hampshire breed chicks (Expt. 1) are given in Table 3. The chicks fed added levels of fat grew at a rate similar to that for the chicks fed the basal ration. Food and caloric efficiency data indicate the fat added to the basal

ration at the 2 and 4% levels was efficiently utilized but complete utilization of the added fat was not observed when 8% fat was added.

Neither choline nor antibiotic-vitamin B₁₂ supplementation stimulated growth nor increased food efficiencies. The mortality and the incidence of perosis were negligible and feathering of the chicks appeared normal in all the groups tested.

The results obtained with White Rock breed chicks (Expt. 2) are shown in Table 4. These results show no increase or decrease in the growth responses of females due to the addition of 2, 4 or 8% fat to the basal ration. An increased weight response of the males was observed with all levels of fat tested and the weight increase observed with 8% fat was statistically significant. Unfortunately, the insufficient number of male birds in this experiment prevented a more detailed evaluation.

TABLE 4.—*Gain and feed utilization of White Rock chicks fed graded levels of fat*

Supplements to basal ration	No. chicks	No. ♂♂	Ave. wt. ♂♂ 4 wks.	Ave. wt. ♀♀ 4 wks.	Food eff. 4 wks.	Cal. eff. 4 wks.	Ave. wt. ♀♀ 6 wks.	Ave. wt. ♀♀ 6 wks.	Food eff. 6 wks.	Cal. eff. 6 wks.	Ave. wt. ♂♂ 9 wks.	Ave. wt. ♀♀ 9 wks.	Food eff. 9 wks.	Cal. eff. 9 wks.
None	25	15	gm. 388	gm. 333	0.49	13.9	gm. 713	gm. 642	0.45	12.8	gm. 1,269	gm. 1,114	0.39	11.1
2% Fat	20	12	355	322	0.48	13.3	719	653	0.45	12.4	1,390	1,167	0.40	11.0
4% Fat	24	2	352	309	0.50	13.4	761	606	0.44	11.8	1,405	1,067	0.40	10.6
8% Fat	20	7	330	320	0.46	11.7	703	636	0.46	11.7	1,374	1,172	0.43	10.9
0.2% Choline	23	5	388	378	0.51	14.5	761	690	0.46	13.1	1,286	1,143	0.40	11.2
0.2% Choline +2% Fat	25	13	401	360	0.55	15.2	771	656	0.48	13.3	1,345	1,112	0.42	11.7
0.2% Choline +4% Fat	26	9	368	357	0.52	13.9	719	659	0.49	13.1	1,329	1,142	0.44	11.7
0.2% Choline +8% Fat	26	4	382	348	0.52	13.3	748	637	0.48	12.2	1,385	1,112	0.43	10.9
0.2% Choline+ 0.25% Aurolac	25	9	414	370	0.49	13.9	803	675	0.46	13.1	1,397	1,133	0.40	11.4
0.2% Choline+ 0.25% Aurolac +2% Fat	25	12	419	376	0.53	14.6	821	683	0.49	13.5	1,430	1,140	0.42	11.5
0.2% Choline+ 0.25% Aurolac +4% Fat	23	4	452	367	0.50	13.4	816	670	0.46	12.3	1,434	1,153	0.42	11.1
0.2% Choline+ 0.25% Aurolac +8% Fat	24	6	417	372	0.54	13.8	901	690	0.50	12.7	1,576	1,204	0.44	11.2

The results on food and caloric efficiencies show that the fat added to the diet was efficiently utilized at all levels studied.

Supplementation of the test diets with choline or choline plus antibiotic-vitamin B₁₂ showed a statistically significant increase in the weight of the female chicks at the fourth week ($P>.01$) but this advantage was not evident at the termination of the experiment. No significant increase in gain of the females was evident when the antibiotic and B₁₂ was added in addition to the choline. The increase in weight of the males, however, was statistically significant ($P>.01$) attributable to feeding choline plus antibiotic and B₁₂ supplement at nine weeks as well as at four and six weeks of age. It is also of interest that the addition of choline plus the antibiotic and B₁₂ supplement increased the rates of gain of the males as compared to the results for choline alone.

Gross observations of carcass quality for ten birds that received the basal ration supplemented with choline and ten birds that received the basal ration supplemented with choline plus 8% fat showed no differences between these groups. All

carcasses were judged excellent and no significant differences in dressing percentages were observed between the two groups.

The fatty acid composition of the depot fat of two males fed the choline plus antibiotic-vitamin B₁₂ supplemented ration and two males fed this ration plus 8% fat was determined. The amount of mono-unsaturated fatty acids was increased and the amount of linoleic acid was decreased in the depot fats of the birds fed added fat as compared with the amounts in the depot fats of the birds fed the basal ration (Slover and Dugan, 1952). It is of interest that the composition of the depot fat of the birds fed the added fat paralleled the composition of the pork fat that was fed.

The results of the experiments reported here show that the performance of chicks fed added levels of fat is equal to, or better than chicks fed rations without added fat. Therefore, the nutritive content (protein, minerals, vitamins) in the basal ration was in excess of the requirements of the chick and the dilution of these nutrients per calorie when fat was added did not result in a retardation in

growth. The slightly superior rates of gain observed in certain of the tests with added fat indicate that some benefit was obtained by the chicks from an increased caloric density of the ration.

It is of interest that no differences in the rates of gain were observed in the first experiment or at the termination of the second experiment attributable to the addition of a choline or choline plus antibiotic and vitamin B₁₂ supplement. In the second experiment, however, either choline or choline plus the antibiotic and vitamin B₁₂ supplement increased the rates of gain of both sexes during the early phases of the experiment but no effect of adding these supplements was evident for the females after nine weeks on experiment.

SUMMARY

The effect of adding 2, 4 or 8% fat (choice, white grease) on the rate of gain, food and caloric efficiency of New Hampshire and White Rock chicks for a period of nine weeks was investigated. A basal ration, formulated from ingredients commonly used in practical type diets, was used, and the addition of choline or choline plus antibiotic and vitamin B₁₂ supplement was also studied.

The experiments with New Hampshire breed chicks showed that 2, 4 or 8% fat added to the basal ration did not increase or decrease the rates of gain and that the calories from fat were efficiently utilized at the 2 and 4% levels of fat but the calories were not completely utilized when 8% fat was added to the ration. No increase in the rate of growth was observed for New Hampshire breed chicks when the rations were supplemented with choline or choline plus an antibiotic and vitamin B₁₂ supplement.

An increased rate of gain of White Rock chicks was observed during the early

phases of the experiment when choline or choline plus antibiotic and vitamin B₁₂ supplement was fed, but this response was not observed in the females at nine weeks of age. The White Rock male birds showed a weight response to choline plus antibiotic and vitamin B₁₂ supplementation and also to the addition of 8% fat in the diet throughout the experiment. Certain observations on the carcass quality and fatty acid composition of the depot fats were made.

These results indicate that the performance of chicks fed 2-8% added fat (choice white grease) was equal to that for chicks fed the basal diet without added fat. Little or no advantage was observed that was attributable to choline or choline plus antibiotic and vitamin B₁₂ supplements at nine weeks of age.

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